JOSIAS RIVER

AT PERKINS COVE

OGUNQUIT, MAINE

SMALL BOAT NAVIGATION PROJECT

RECONNAISSANCE INVESTIGATION

TECHNICAL APPENDIX

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

JULY 1982

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INTRODUCTION

This report is a preliminary engineering and economic feasibility study of navigation improvements in the Josias River and Perkins Cove, Maine.

The Josias River, where it empties into the Atlantic Ocean at Perkins Cove, forms a small, well protected harbor, which is home port to the commercial fishermen of the town of Ogunquit, Maine. Ogunquit is located 15 miles northeast of the city of Portsmouth, New Hampshire and is one of several scenic resort communities scattered along the southern Maine coast.

At the request of local fishermen, the town of Ogunquit arranged a meeting of town officials, local interests, and representatives from the U.S. Army Corps of Engineers. At that meeting held on 22 April 1981, local interests identified a specific navigation problem relative to the existing Federal project and their own plans for modernization of their fleet. For this reason several local interests have requested that the deepening of the existing basin from a depth of five feet mlw to a depth of seven feet mlw be studied.

In a letter dated 8 May 1981 the town of Ogunquit officially requested that the Corps of Engineers study the feasibility of Federal participation in improving navigation conditions in the Josias River and Perkins Cove under existing continuing authorities for small navigation projects.

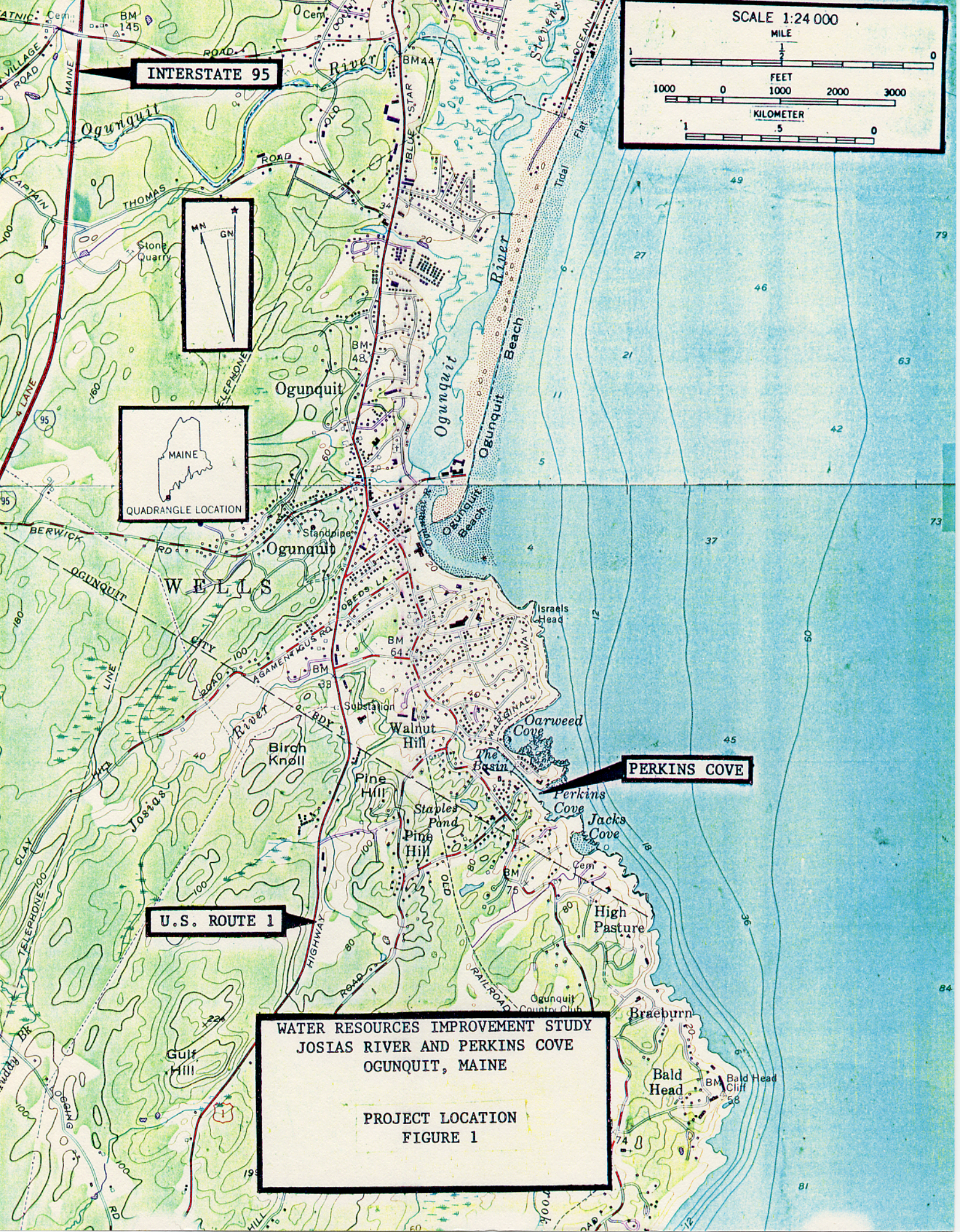
The geographic scope of this study was generally limited to the tidewater portion of the Josias River, Perkins Cove, and the town of Oqunquit as shown in Figure 1.

Study Authority

This reconnaissance report was prepared and is submitted under the authority and provisions of Section 107 of the 1960 River and Harbor Act, as amended.

Prior Studies & Improvements

Federal - Federal interest in the Josias River at Perkins Cove began with a Preliminary Examination published in 1911. The study focused on providing a breakwater between Adams Island and the mainland and dredging a channel from Perkins Cove to Flat Pond, the site of the present day basin. The findings of this report were unfavorable as were the findings of a subsequent report completed in 1930. This second report, also a Preliminary Examination focused on providing an access channel 40 feet wide, 3 feet deep mlw from the cove to Flat Pond.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3000
KILOMETER
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INTERSTATE 95
U.S. ROUTE 1
PERKINS COVE
MAINE
QUADRANGLE LOCATION
MN
GN
Ogunquit
Ogunquit River
Ogunquit Beach
Tidal Flat
Stevens
OCEAN
BLUE STAR
OLD
ROAD
THOMAS
CAPTAIN
Stone Quarry
BM 145
BM 44
BM 48
BM 64
BM 75
Cem
TELEPHONE
4 LANE
95
BERWICK
RD
Standpipe
OGUNQUIT
W E L L S
CITY
LINE
AGAMENTICUS RD
OBEDS LA
Israels Head
WAY
MARQUINAS
Substation
BDY
Josias River
Birch Knoll
Walnut Hill
Pine Hill
Staples Pond
Oarweed Cove
The Basin
Perkins Cove
Jacks Cove
High Pasture
HIGHWAY
RAILROAD
Ogunquit Country Club
Braeburn
Bald Head
Bald Head Cliff
Gulf Hill
CLAY
HILL
OGUNQUIT
RD
WATER RESOURCES IMPROVEMENT STUDY
JOSIAS RIVER AND PERKINS COVE
OGUNQUIT, MAINE
PROJECT LOCATION
FIGURE 1

A third Preliminary Examination completed in 1935 resulted in a favorable survey report published in 1939. The survey recommended Federal involvement in construction of a navigation project consisting of a 40 foot wide access channel, 5 feet deep mlw, extending about 900 feet from deepwater in Perkins Cove to an anchorage in Flat Pond. The anchorage was also 5 feet deep at mlw, with an area of 3.2 acres.

The recommended improvement was authorized under the River and Harbor Act of 2 March 1945. Construction was completed in 1951 and consisted largely of removing rock pinnacles since local interests had themselves dredged the basin and channel during the war.

A survey study authorized in 1949 and completed 9 May 1957 studied the feasibility of providing a breakwater extending southeast from Adams Island 350 feet to the ledge at the entrance to Perkins Cove. The report found this plan to be economically unjustifiable. The survey report recommended an enlargement of the existing anchorage by an area of 1 acre at a depth of 5 feet at mlw to provide a total anchorage area of about 4.2 acres. This modification was authorized on 3 July 1958. Construction of this improvement was completed in March 1960.

The existing Federal project, shown in Figure 2, is the result of the above mentioned studies and authorizations.

Improvements by Others - Local improvements in the Josias River began in the early 1900's when the River's course was changed so that it would empty into Perkins Cove through a manmade channel. The old river mouth at Oarweed Cove was filled in. This improvement enabled vessels mooring in Oarweed Cove to use the now larger and more sheltered Perkins Cove. Between 1928 and 1941 local interests attempted to maintain a channel between Perkins Cove and Flat Pond which would be navigable at all stages of the tide. These attempts were largely unsuccessful.

Following the favorable recommendations of the 1939 Federal survey report, local interests dredged the basin in Flat Pond and the channel to Perkins Cove in 1941. The dredged material was used to construct a breakwater and causeway between Adams Island and the mainland north of the basin (see Figure 3). This structure has been enlarged over succeeding years so that it now serves as a pier and parking area. The pier is also the site of several buildings and a public dock on the north side of the basin.

CORPS OF ENGINEERS

U. S. ARMY

OGUNQUIT

FALLS AND RAPIDS

0.25 MI.

FLAT POND

0.2 MI.

5' ANCHORAGE

BULKHEAD

BULKHEAD

OARWEED COVE

WALNUT HILL

BULKHEAD

DOLPHINS

FOOTBRIDGE

DOLPHINS

0.15 MI.

BULKHEAD

5' CHANNEL

MARINE RAILWAY

0.1 MI.

BULKHEAD

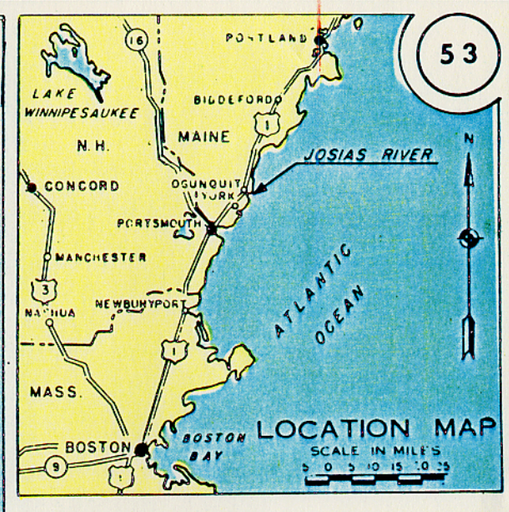
LEDGE PINNACLES

0.05 MI.

PERKINS COVE

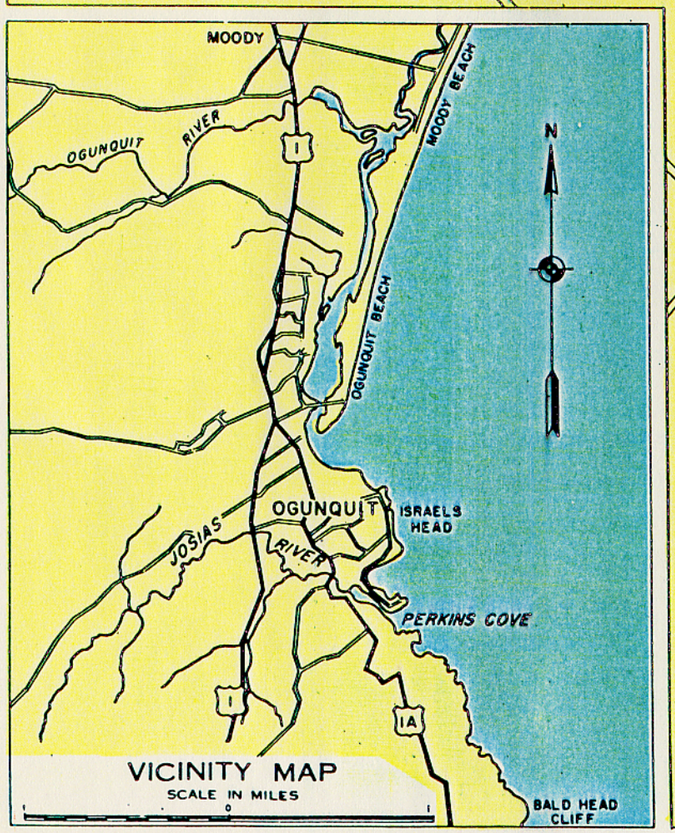
0.0 MI.

N



BRIDGE CLEARANCES

FOOTBRIDGE (LIFT)
Hor. 43.5 ft.
Vert. 15 ft. M H W.



WATER RESOURCES IMPROVEMENT STUDY
JOSIAS RIVER AND PERKINS COVE
OGUNQUIT, MAINE

EXISTING FEDERAL PROJECT

FIGURE 2

IN 1 SHEET

SCALE IN FEET
100 0 100 200

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

PROBLEM IDENTIFICATION

Existing Conditions and Problems

Perkins Cove, in the town of Ogunquit is located on the southeastern coast of Maine, about 33 miles southwest of Portland and lies within the first congressional district. Ogunquit became a town in 1980 and was formerly a self-governing village corporation within the town of Wells. Ogunquit has a year round population of 1,492, representing a 58.1 percent increase over 1970, as reported in the U.S. Census Bureau report for 1980. This is slightly higher than the average increase for the State as a whole which was 13.2 percent over the same ten year period. The influx of seasonal residents to this resort community elevates the population during the summer months. Ogunquit may be reached via U.S. Route 1. Access to Perkins Cove is provided by Route 1A.

As shown in figure 1, Perkins Cove is located south of the village center and is Ogunquit's only harbor. Originally the Josias River flowed into Oarweed Cove after meandering across the marsh known as Flat Pond. Local interests changed the river's course so that it emptied into Perkins Cove through a channel cut across the bar between Adams Island and the mainland to the west. The old channel was filled and eventually became the site of the present day pier. This existing pier was originally constructed as a breakwater between Adams Island and the mainland to the northwest. The structure was later enlarged to its present condition to support several buildings, a public parking area and a public dock. The Flat Pond marsh and the channel were first dredged by local interests and in later years by the U.S. Army Corps of Engineers to form the existing 4.2 acre, 5 foot deep mlw anchorage basin and the 40 foot wide, 5 foot deep mlw access channel.

The present channel bottom is composed of coarse sand and gravel overlying hard glacial till deposits and bedrock ledge. The basin bottom in Flat Pond is composed of a thin layer (less than one foot) of sandy organic silt overlying fine sands and gravels. Sediment samples taken in 1975 showed levels for percent fine particles (passing #200 U.S. Standard Sieve Mesh) ranging from 5.0 in the access channel to 76.3 in the Pond Basin. The cove bottom ranges in depth from - 5 feet mlw at the access channel to - 25 feet mlw.

Both recreational and commercial vessels use Perkins Cove and the Josias River Basin. Based on information supplied by local officials there are approximately 34 commercial fishing vessels, 8 charter fishing vessels, and 50 recreational vessels which use the existing project. Additionally many transient vessels use the habor each year. The project area has a tidal range of 9.7 feet. The project area can be located on the U.S. Geological Survey Map titled "York, Maine," or National Ocean Survey Chart #13286 titled "Cape Elizabeth to Portsmouth."

The growing summer and tourist populations and waiting lists for anchorage space indicate that the Ogunquit area and Perkins Cove could easily support an increase in both the commercial and recreational fleets if more anchorage area could be provided. Current economic conditions have led to a trend toward more efficient deeper draft fishing vessels. Recently the commercial fleet has been reduced by three boats which left the fleet due to the decreasing viability of operating small draft vessels in the commercial fishing industry in New England.

The recreational boating industry in New England is currently undergoing a rapid rate of growth. In the southern Maine Coastal Area this is related to an increase in the construction of seasonal second-homes. The seasonal population in Ogunquit during the summer is higher than the year-round population. The total summer fleet, both commercial and recreational, at Perkins Cove is 114 percent higher than the year-round exclusively commercial fleet. There is an increasing demand for more safe anchorage areas for seasonal recreational craft along the entire Maine southern coast including Ogunquit. A waiting list for summer mooring space at Perkins Cove has steadily grown as the summer population has increased. Similar waiting lists for permanent seasonal mooring spaces exist for all neighboring ports. Development of additional safe mooring areas in Ogunquit would require the construction of major structures. Provision of adequate safe anchorage in outer Perkins Cove would entail construction of a breakwater as was evaluated in previous Federal reports, all with negative findings. Development of a new anchorage behind Ogunquit Beach in the Ogunquit River would require modification of the existing fixed span bridge at the river's mouth which only has a height of about 5 feet above mlw. A reorganization of mooring patterns in Perkins Cove basin could allow for a very limited increase in total fleet size but would not allow for deeper draft boats.

The trend toward larger commercial fishing vessels has led to a lack of adequate depth for these deeper draft boats within the anchorage area and entrance channel. This has resulted in lost fishing time, reduced landings, and increased labor and fuel costs caused by delays due to tidal navigation. Damages due to groundings have also increased as more deeper draft vessels are added to the fleet.

The navigational needs of the community as developed through identification of its problems are evident. Adequate access channel and anchorage depths must be provided for the new larger commercial fishing vessels which are replacing the aging vessels now gradually leaving the fleet. New anchorage area must be provided if the Ogunquit area's full potential for an increased recreational fleet is to be realized.

Conditions If No Federal Action Taken

If no Federal action is taken at Perkins Cove, the present conditions will persist and current trends will be likely to continue. Depth limitations in the channel and basin will continue to discourage the navigation

of vessels drawing greater than 3 1/2 - 4 feet. Boats of this type now in the fleet will continue to experience grounding damages and delays due to tidal navigation. To eliminate these adverse effects without Federal action, larger vessels must relocate their base of operations to a nearby port affording greater ease of navigation or some party other than the Federal government must provide for the deepening of the entrance channel and a suitable portion of the basin at Perkins Cove.

Since the winter fishing season of 1977-78 the commercial fishing fleet has lost three vessels whose owners have left the industry due to the rising costs associated with maintaining small draft vessel operations which yield small catches. Those fishermen who have chosen to remain in the industry will continue the present trend toward upgrading the fleet through investing in modern deeper draft boats with the longer ranges and larger holds which enable them to harvest offshore fish resource stocks. Those who invest in these larger vessels would have to choose between either remaining at Perkins Cove, thereby incurring grounding damages and experiencing tidal delays, or transfering to another port capable of handling a larger, deeper draft fishing fleet. Of the six commercial fishing ports within a 20 mile commute of Perkins Cove, none is entirely suitable as an alternative port to which the deeper draft commercial boats could transfer. All nearby ports within a reasonable commute also experience severe overcrowding during the warmer months. Transfer to other ports farther away would necessitate moving homes and families as well as vessels. This alternative entails what most fishermen feel is excessive cost.

As commercial fishermen leave the fleet, their moorings are being taken up by seasonal recreational vessels. This keeps the seasonal combined fleet at a fairly constant level. However, this trend can lead to a lower level of activity and a decline in port economy since a year-round source of income to the community would be replaced by a seasonal source of income.

It is highly unlikely that any interests other than the Federal Government would be willing to provide the improvements necessary to stabilize the Perkins Cove commercial fishing industry. State funding for port development is aimed primarily at the major industrial ports and fishing ports with the greatest landings. Local interests are incapable of securing their own capital to invest in harbor improvements.

FORMULATION AND ASSESSMENT OF A SINGLE PLAN

As stated in the introduction section, the purpose of this report is not to formulate and assess the optimum plan of improvement but only to determine if there is some feasible plan that may prove to be in the Federal interest. This is done only as a decision-making tool to evaluate the need for detailed study of many alternatives. The plan evaluated herein is not necessarily the plan that will be selected after a detailed analysis is performed. This plan is evaluated over the others based upon the data available at this early stage of study and recognition of local desires.

Plan Formulation

The limited scope of this reconnaissance investigation requires that certain basic assumptions be made in formulating a plan of improvement.

The only plan involving no Federal action and no structural improvements would entail transfer of the modern deeper draft commercial vessels to another nearby port. This plan also calls for any potential for increased recreational boating activity in the Ogunquit area to also be developed only at alternative ports.

At this stage of study, transfer of a significant portion of the commercial fleet appears impractical. There are seven other harbors used as a base for commercial fishing operations on the southern Maine coast within a reasonable commute of Ogunquit.

The closest of these is Cape Neddick Harbor, 4 miles to the south by land, which has a very small inshore fleet and inadequate depths for offshore vessels. Three others, Biddeford pool, 26 miles north, the Kennebunk River, 5 miles north, and Kittery, 17 miles to the south, are currently experiencing navigation difficulties with depths in channels and anchorages. All three of these harbors are currently the subject of Corps Section 107 navigation studies aimed at providing for deeper draft commercial fishing operations. Wells Harbor, 9 miles to the north, is currently the subject of a Corps study to alleviate severe shoaling problems which are restricting navigation. York Harbor, 10 miles to the south, and Cape Porpoise Harbor, 18 miles north, are both experiencing overcrowded summer conditions, therefore year round transfer to these ports is impractical.

Rationale and Alternatives

At present the total fleet at Perkins Cove numbers 92 vessels, of which 50 are seasonal recreational craft and 42 are commercial fishing vessels. Of the 50 recreational boats, 9 currently experience problems with tidal delays and grounding in the channel and basin because of drafts exceeding 4 1/2 to 5 feet. Throughout the summer season many large cruising sailboats taking part in races along the New England coast stop over at Perkins Cove, usually for one night only. Because of shallow

depth and limited available anchorage this number averages only three boats per night over the entire 120 day cruising season. These transient boats are the equivalent of three full-time vessels. For purposes of evaluation two of these transient sailboats are assumed to be in the 21-30 foot range, while the other boat is in the 31-40 foot range. Of the 42 commercial boats, 28 are onshore lobster boats, 6 are draggers and 8 are charter fishingboats. The total number of operators and crew in the commercial fleet is 62. All of the commercial fleet operates year round. Ice forming in the harbor basin during winter months is broken up each morning by the harbormaster, who operates a municipal icebreaker. One transient commercial dragger operates out of Perkins Cove during the winter season. Because of inadequate depths three draggers have left the fleet in the past 2 years and transferred to other ports. If a deeper harbor were provided these vessels would return to Perkins Cove year round. A poll of Ogunquit fishermen has shown that five would invest in new vessels if improvements were accomplished. Three of these modern replacement boats would be larger draggers, one a new charter boat and one a new lobster boat.

In summary, if improvements were to be provided 26 boats would require deeper mooring and access in order to avoid grounding damages. These boats include the 9 recreational boats which currently experience problems, the 3 commercial fishing boats which would return to the harbor, the 5 modern replacement commercial boats, the 3 transient recreational boats, and the 6 existing draggers. By using the existing local mooring system and segregating all deeper draft boats into one area a total of 2.1 acres of deeper anchorage would be sufficient to safely accommodate these vessels.

Deeper draft vessels attempting to navigate through the basin occasionally collide with and damage moorings and lobster cages (dummies) which each lobsterman leaves attached to his own mooring. Damage to moorings usually involves cut chains which are repaired by a diver hired by the harbormaster. Each such instance of cut mooring costs the town about $50 to repair. The harbormaster has stated that such collisions occur on the average of 10 times each year. For purposes of analysis half of these moorings will be considered to be for recreational vessels and half for commercial vessels.

The largest commercial vessels presently using Perkins Cove are draggers that have loaded drafts of up to 7 feet. The charter vessels when loaded with a party of 30 to 50 people have maximum drafts of 6 feet. The majority of the fleet's inshore lobster boats draw 4 feet fully loaded as does the municipal icebreaker. The smaller draft vessels only experience grounding damages during extremely low tides and periods of heavy seas that cause wave heights of rarely greater than 1 foot in the basin.

The rock ledge that underlies much of the basin is most extensive and closest to the surface in the upper half of the anchorage area. Since removal of ledge rock entails excessive cost any area to be deepened must be restricted to the lower reaches of the basin.

Provision of breakwaters to protect a portion of Perkins Cove as a new anchorage has not been examined in detail at this stage. A similar plan was proposed in the 1958 survey report and not recommended because of the high cost of local involvement for constructing such structures. Such a plan providing for about three additional acres of anchorage will be examined in detail if any further study is recommended.

Provision of a new anchorage basin behind Ogunquit Beach, while feasible from an engineering standpoint, would be economically unjustifiable. To provide improvements in that area an excessive amount of material would have to be removed and the existing fixed span, wooden pile bridge would have to be modified.

Quantity estimates within the Flat Pond Basin are based on a Corps hydrographic condition survey conducted in June 1976. Quantity estimates for ledge rock are based on probings conducted for the original 1939 survey report.

The town of Ogunquit has indicated that it can secure a suitable upland disposal site for material to be removed. One site is an old quarry seeking fill material and the other is landfill operated by the municipal sewer district. For purposes of cost analysis the average distance from the project site to these areas is 4 miles. As the rock, till, and sandy material is dredged it will be placed on shore adjacent to the basin to dewater. Dewatering will occur quickly because of the coarse and impervious nature of most of the material. After dewatering the material would be trucked to the upland disposal site 4 miles away. To remove the 11,600 cubic yards will require about 1,200 truckloads. Because of the limited area available for dewatering and the coarse or impervious nature of the clean material, dewatering will be accomplished through runoff and no retention dikes will be necessary.

If a detailed study is performed, an attempt will be made to identify all technical and feasible alternative plans.

Alternative Plan Chosen for Evaluation

An economically feasible plan has been developed which entails deepening of the existing -5 foot mlw entrance channel and the lowermost 2.1 acres of the Flat Pond Basin by a 2-foot increment. This would provide a depth of -7 feet mlw in the channel and lower portion of the basin. Such an improvement would provide safe access to all but the largest vessels in the Perkins Cove fleet at all stages of the tide. Vessels drawing 7 feet would experience only very minor delays of between 40 minutes and one hour at extreme low tides and during rough weather.

The plan to be evaluated is shown on Figure 3. It provides for a channel 950 feet long from deep water in Perkins Cove to the anchorage basin in Flat Pond. The channel would be deepened to -7 feet mlw and retain its present authorized width of 40 feet, which allows for safe one way traffic. The evaluated plan also provides for deepening the lower 2.1 acres of the existing authorized basin to -7 feet mlw without any alteration of the authorized project limits.

Based on previous probings it is not anticipated that any rock removal will be necessary to deepen the lower portion of the basin. However, ledge rock is known to exist in the entrance channel and past Corps improvements have involved ledge removal. Under the evaluated plan rock in the channel would be removed to a depth of -7 feet mlw plus a 2-foot overdepth to yield a total quantity of 980 cubic yards of rock. In addition, a total quantity of 10,600 cubic yards of ordinary material must be removed from the channel and lower portion of the basin to provide an overall depth of -7 feet mlw plus one foot of overdepth in areas where material other than rock is encountered.

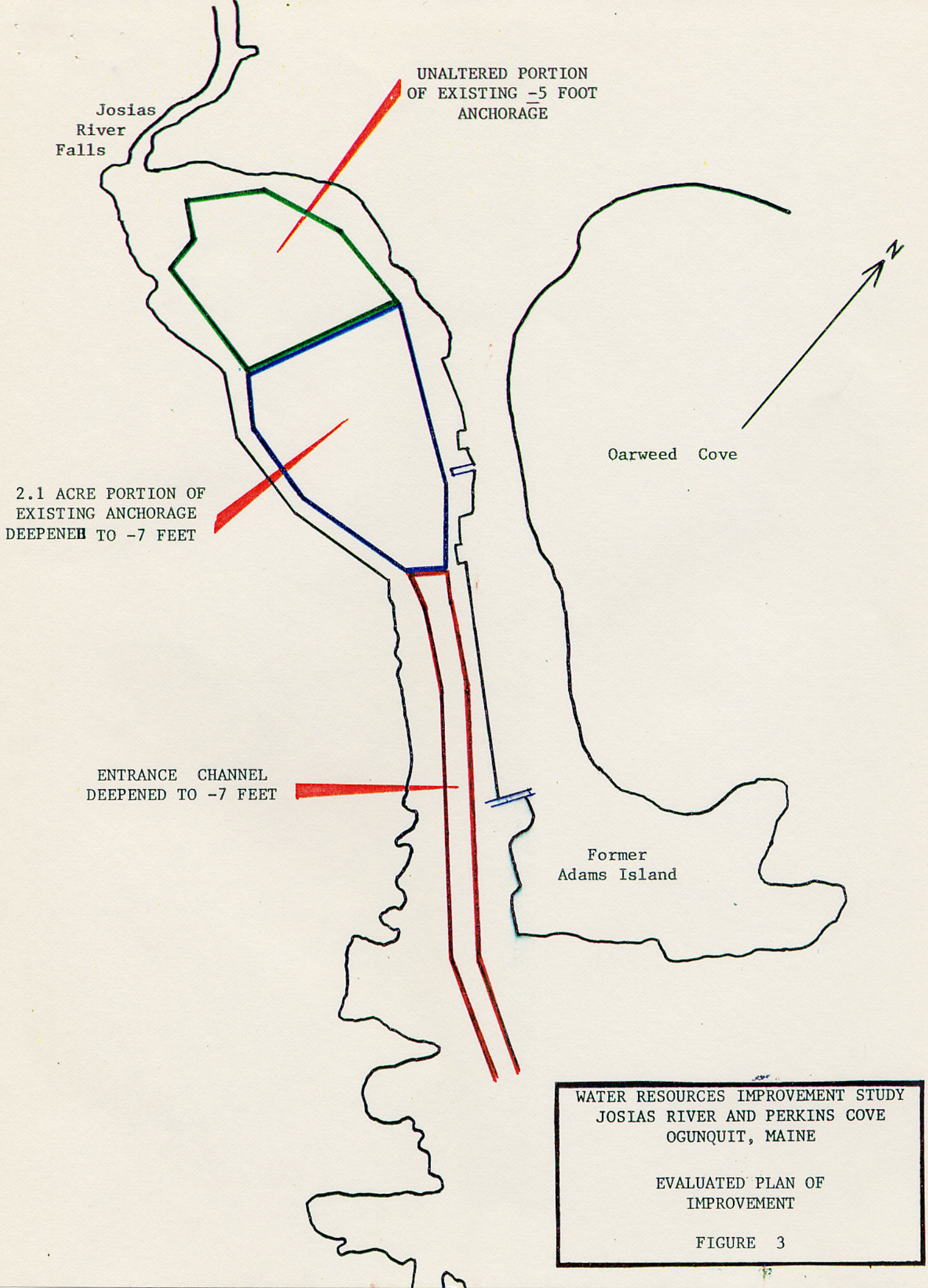
Estimate of First Costs

The evaluated plan of improvement would involve deepening of an access channel and a portion of the existing anchorage area. Construction would be accomplished by use of a clamshell bucket dredge after blasting the ledge to be removed. The material would be dewatered at the dredge site. Following dewatering the material would be trucked to the disposal site and used as fill. The estimated first cost is shown in Table 1 below.

Specific costs for navigation aids will be obtained from the US Coast Guard during the detailed project report stage. At this time it is assumed that no additional aids to navigation would be required. Table 1 depicts the first cost of the evaluated plan of improvement.

TABLE 1
FIRST COSTS
EVALUATED PLAN OF IMPROVEMENT

Dredging of Channel and Anchorage		
Ledge removal	980/c.y. @ $120.00/c.y	$118,000
Ordinary material	10,600 c.y. @ $10.00/c.y.	106,000
Load and truck to disposal site		
11,600 c.y. @ $6.00/c.y.		70,000
Subtotal #1		$294,000
Contingencies (25%)		$ 74,000
Subtotal #2		$368,000
Engineering and Design (8%)		29,000
Supervision and Administration (8%)		29,000
TOTAL FIRST COST		$426,000



WATER RESOURCES IMPROVEMENT STUDY
JOSIAS RIVER AND PERKINS COVE
OGUNQUIT, MAINE

EVALUATED PLAN OF
IMPROVEMENT

FIGURE 3

Estimate of Annual Charges

Annual charges are based on an estimated project life of 50 years and an interest rate of 7 5/8 percent. Maintenance is based on the annual shoal rate of 2 percent for the existing Federal project. The annual charges are shown in Table 2.

It is assumed that maintenance of the improvement would be required twice over the project life. At a shoal rate of 2 percent each maintenance operation would require removal of about 6000 cubic yards at a total cost of about $204,000 each time or $8,000 on an annual basis. Disposal of maintenance material would be in the same manner as the improvement.

TABLE 2
ANNUAL CHARGES
EVALUATED PLAN

Amortization of First Costs	
$409,000 x 0.07823	$33,000
Annual Maintenance Dredging	
$408,000 ÷ 50 years	$ 8,000
TOTAL	$41,000

Estimate of Benefits

Navigational improvements in the Josias River at Perkins Cove would result in significant benefits to the existing commercial fishing fleet, recreational boating interests and commercial charter boat operators. Recreational benefits have been computed on the basis of increased leisure time available to boat owners after elimination of tidal delays and a reduction in damages. Benefits to commercial fishing vessels are based on the increase in landings attributed to an elimination of tidal delays and replacement of existing vessels with larger modern vessels. Benefits to commercial charter boats have not been assessed at this time due to a lack of data. Benefits attributable to reductions in damages due to groundings in the anchorage and channel and reduced vessel repair time (increased fishing time) have been assessed for all types of vessels. All benefits have been computed in accordance with the established policies of the Corps of Engineers.

Commercial Benefits

Benefits to commercial fishing operations would result from deepening of the entrance channel and anchorage to provide safer access and ease of navigation to deeper draft boats. Provision of a deeper channel would allow for an increase in fishing time and increased catch for daily operations such as finfishing and a reduction in spoilage of catch for all boats forced to wait for the tide when coming in to offload.

A deeper anchorage would also reduce damages due to groundings, including cut moorings and destruction of lobster dummy cages and resulting escaped catch. As with recreational boat moorings, five commercial boat moorings are grounded on each year. The average repair cost for each mooring is $50 for a total benefit of $250. It is estimated that an average of 10 lobster dummy cages are grounded upon and broken open each year. The average dollar value of the escaped catch is $300 while the replacement value of the dummy cage is about $30, making the total damages from such collisions equal to $3,300. It is a reasonable assumption that deepening of the anchorage would reduce the number of such collisions by 80%, yielding an annual benefit of $2,640.

Currently tidal delays are experienced both outbound and inbound an average of 6 days per month. Such delays result in a wait of 3 hours for the deeper draft finfishing boats. When lower tides occur in conjunction with wave heights of 2 feet or greater in the entrance channel the inshore lobster boats will also experience a delay of about 2 hours in order to insure safe passage.

Provision of a 7-foot deep mlw entrance channel would totally eliminate delays during heavy seas for the inshore lobster boats, which draw an average of four feet. Such improvements would also reduce delays experienced by the larger finfishing draggers to a maximum of one hour during periods of heavy seas. It is a reasonable assumption that this would reduce spoilage of catch by 60% of the present $44,000 total annually lost, or a total benefit of $26,400 for the six finfishing vessels in the fleet.

Each of the 28 inshore lobster boats currently loses 1,200 pounds of lobster, or 33,600 pounds annual fleet total, due to spoilage of catch. The spoilage is mainly caused by tidal delays encountered inbound which would be completely eliminated by a 7-foot deep mlw entrance channel. Some of this spoilage is due to lobsters stored in dummy cages on the anchorage bottom, dying off during periods of high volume fresh water run-off from the Josias River. Most of this in-storage kill will be eliminated by the increased salt water tidal flushing and mixing that will result from the increased cross sectional area of the deeper channel. It is reasonable to assume that as much as 60%, or 20,000 pounds, of the total annual spoilage loss of 33,600 pounds could be saved. At a price of $2.50 per pound of lobster this benefit is equal to $50,000 a year.

The current lobster catch of 420,000 pounds annually is most likely the maximum yield of the resource in that area. It is unlikely that any increase in catch could be sustained. Lobstermen at Perkins Cove are currently averaging 1/2 pound per trap per day. Any increased catch would most likely lead to a decline in the area's available stocks. For this reason no benefit would be derived from increased fishing time for lobstermen.

Finfishing vessels, however, will derive a benefit from increased fishing time due to reduction in tidal delays. A 3-hour wait for the tide will cost a dragger one set of lines or tow each time a delay occurs. Each set lands a catch valued at about $250. This situation, which occurs about four times a month, would provide a total benefit to the six dragger operaters of $72,000 annually.

With a deeper anchorage the three finfishing boats recently lost to the fleet would be replaced yielding the equivalent of three new boats. The average Perkins Cove dragger boat lands 210,000 pounds of finfish annually, worth $70,000. Three new boats, each landing the average catch would yield about 630,000 pounds in new landings. Much of the finfish landed at Perkins Cove is halibut and other higher priced species, including 64 tuna worth about $90,000 landed during the 1980 season. An average ex-vessel price of $0.30 per pound when used with a net return factor of 50 percent will yield a benefit of $93,000

TABLE 3
SUMMARY
COMMERCIAL BENEFITS

Reduced Damages to Mooring and Lobster Cages (and reduced escaped catch)	$ 3,000
Reduced Finfish Spoilage	26,000
Reduced Lobster Spoilage	50,000
Increased Finfish Catch (reduced delay)	72,000
3 New Finfish Boats	93,000
TOTAL COMMERCIAL BENEFITS	$242,000

Additional benefits which cannot be accurately assessed at this preliminary stage but would be studied in full in any Detailed Project Report would include:

•Benefits to the transient commercial winter boats presently using Perkins Cove and expected to use the improved cove.

•Benefits to the seasonal transient commercial tuna boats using the cove.

•Benefits derived from reduced fuel and labor costs as a result of reduced tidal delays.

•Increased catch due to modernization of the fleet through replacement of older existing boats with new deeper draft-larger hold vessels.

•Benefits derived from increased use of charter fishing vessels.

Recreational Benefits

Benefits to recreational boating would result from the evaluated plan of improvement at Perkins Cove. Recreational benefits are derived from leisure time saved to boaters and reductions in damages and operating costs. Leisure time is saved through reductions in tidal delays and vessel repair time. Reductions in damage costs result from reduced groundings in the channel and anchorage and reduced damages to moorings. Benefits have been determined for both the existing permanent and transient recreational fleets, based on their estimated number of days in use.

It is assumed that over the 200-day recreational boating season any boat would be used an average of one fifth of the time or 40 days per year. Many of the boats in the larger classes would be out of port on cruises during the 120-day cruising season. The number and duration of these cruises will vary with the size and range of vessel and is shown in Table 4. According to this methodology the number of vessel trips that any class of boat would make each year into and out of Perkins Cove was determined and is presented in Table 4.

Transient recreational boats commonly use the cove during the cruising season, between mid May and mid September, a 120-day period. On the average, three boats each night make use of the cove. These boats are usually cruising sailboats and would equal three full-time equivalents. Each of the three full-time equivqlent transient boats would make 120 trips per year during the cruising season.

As with commercial vessels the probability of a recreational boat encountering tidal delays in transiting the entrance is one delay, either inbound or outbound, for every six round trips. The length of the delay will depend upon the draft of the vessel. With allowances for one foot waves, one foot of clearance and one half foot of squat underway, a safe clearance of 2.5 feet under the keel would be necessary. The average delay would occur at exact low tide when a boat must wait for the tide to rise to the proper safe depth. The maximum delay would occur when a vessel arrives at the shoal just as the depth of water has fallen below the necessary clearance, forcing the boat to wait for the tide to fall to low and rise again. The average drafts, necessary clearances and tidal delay time saved by the 7-foot channel for each class of boat are shown in Table 5, for both permanent and transient vessels. The duration of the average tidal delay was determined for each class of vessel according to vessel draft. The number of annual boat trips was divided by six to determine the probable number of tidal delays a boat in each class would encounter. From this data the number of hours saved annually for a boat in each class was determined. The above computation is shown in Table 5.

TABLE 4
JOSIAS RIVER AND PERKINS COVE
RECREATIONAL BOATING
HARBOR USE PER BOAT AND FLEET COMPOSITION

Type of Craft	Length	Average Total Days in Use	Time on Cruise: % of 120 Day Cruising Season	Time on Cruise: Annual # of Days out of Port	Extended Cruises: Average Length of Cruise (Days)	Extended Cruises: Annual # of Cruises	# of One Day Cruises	Total Annual Boat Trips Per Permanent Boat	# of Boats in Fleet: Permanent	# of Boats in Fleet: *Transient
Outboard	15 - 20	40	0				40	40	15	
	21 & Up	40	0				40	40	12	
Sterndrive	21 - 25	40	3	4	4	1	36	37	4	
Inboard	15 - 20	40	2	2	2	1	38	39	3	
	21 - 30	40	9	11	7	2	29	31	3	
Cruising Sailboats	21 - 30	40	5	6	8	1	34	35	7	2
	31 - 40	40	16	19	12	2	21	23	2	1
Day Sailers	21 - 25	40	5	6	4	1	34	35	4	—
TOTAL									50	3

*NOTE: Transient vessels make 120 trips per year each.

TABLE 5
JOSIAS RIVER AND PERKINS COVE
RECREATIONAL BOATING
TIDAL DELAY REDUCTION - LEISURE TIME SAVED PER BOAT

Type of Craft	Length	Draft	Optimum Depth With 2.5 Clearance	Average Min Tidal Delay With 5 Foot Channel and 9.7'Tide	Permanent Fleet			Transient Fleet		
					Annual # of Boats Trips Table-4	Annual # of Tidal Delays Trips÷6	Annual Hours Tidal Delay Time Saved Per Boat	# of Boat Trips	Annual # of Tidal Delays Trips÷6	Annual Hours Tidal Delay Time Saved Per Boat
Outboard	15 - 20	1.5	4	0	40	7	0			
	21 & Up	2	4.5	0	40	7	0			
Sterndrive	21 - 25	2	4.5	0	36	6	0			
Inboard	15 - 20	2.5	5	0	38	6	0			
	21 - 30	3	5.5	66	29	5	6			
Cruising Sailboats	21 - 30	5	7.5	216	34	6	22	120	20	72
	31 - 40	6	8.5	276	21	4	18	120	20	92
Day Sailers	21 - 25	3.5	6	108	34	6	11			
TOTAL										

The larger draft vessels in the existing recreational fleet currently experience damages due to grounding in the channel while underway and grounding in the anchorage while moored. Damages to the boats are also incurred when the vessels collide with moorings and lobster dummies at lower stages of the tide. As stated previously, an average of five recreational boat moorings are cut each year, requiring a replacement and repair cost of about $50 each. Local officials have estimated that during the 1980 season the nine larger permanent recreational vessels suffered at least $1,200 damage apiece in hull, keel, and other types of damage due to the lack of depth and the fact that each vessel was out of service an average of nine days for repairs. The actual cost in dollars and loss of time due to damages to transient recreational boats could not be quantified. A reasonable assumption is that deepening of the harbor to -7 feet mlw would result in an 80% reduction in damages due to grounding in the channel and anchorage. This would represent a total annual reduction in damages amounting to $8,640 for the nine deeper draft boats in the existing permanent recreational fleet. It is assumed that the average boating day is 8 hours long. Each boat damaged therefore loses about 16 hours per year of leisure time if it would normally be used on one fifth of the nine days it was undergoing repairs. If improvements reduce damages by 80% then a savings of 13 hours per boat results for the nine permanent deeper draft sailboats.

The three methods available for recreational benefits estimation are found in subpart K of the WRC Manual and are the travel-cost method, contingent value method, and the unit-day value (capacity) method. Because of the limited scope of this reconnaissance investigation and the unique nature of seasonal recreational boating in New England, the unit-day value method was chosen as being the most applicable to measure increased efficiency at the study site.

In most cases the unit-day value method measures an increase in the capacity of the recreation site based on project improvements and the resulting increase in the number of total recreational user days. For the Josias River - Perkins Cove Study it is assumed that the recreational capacity will remain the same under the without and with project conditions. Rather the improvements are designed to reduce navigation problems associated with lack of depth in the channel and anchorage. Deepening the channel and a portion of the anchorage would save time because of reductions in tidal delays especially to boats with deeper drafts. Time would also be saved from reduced vessel repair time.

In order to estimate the total annual dollar value of recreational time foregone the following data were compiled: the profile of the existing and potential boats that would use the anchorage, an estimate of users for each class of boat, the number of average annual trips per boat, and an estimate of unit-day value. The following Table 6 contains an inventory of the recreational fleet as supplied by the town of Ogunquit and updated through site visits. Boat user estimates are based on past studies and interviews. Table 6 shows the total number of user days saved by the proposed improvements.

For purposes of quantifying the 13 hours of vessel repair time for the nine boats damaged annually it was assumed that each would most likely be a cruising sailboat because of their greater drafts. Leisure time saved through reduced tidal delays and vessel repair time were totalled to obtain the total hours saved annually per vessel by class. The number of boats in each class in the fleet, the average number of users per boat and the total hours of leisure time saved were multiplied to determine the total hours that would be saved annually by the evaluated improvement. This computation is shown in Table 6.

TABLE 6
JOSIAS RIVER AND PERKINS COVE
RECREATIONAL BOATING
LEISURE TIME SAVED

Type of Craft	Length	Avg # of Users per Boat Class	Permanent Fleet # of Boats	Permanent Fleet Annual Tidal Delay Time	Permanent Fleet Damage Repair Time	Permanent Fleet Annual Total Hours	Permanent Fleet *Total # of User Hours Forgone	Transient Fleet # of Boats	Transient Fleet Annual Tidal Delay Time	Transient Fleet *Total # of User Hours Forgone
Outboard	15 - 20	2	15	0						
	21 & Up	3	12	0						
Sterndrive	21 - 25	4	4	0						
Inboard	15 - 20	2	3	0						
	21 - 30	4	3	6	—	6	72			
Cruising Sailboats	21 - 30	3	7	22	13	35	735	2	72	432
	31 - 40	4	2	18	13	31	248	1	92	368
Day Sailers	21 - 25	4	4	11	—	11	176	—		—
TOTAL			50				1231	3		800

*Total user hours = Total Annual hours x # of boats x # of users per boat
Total recreational user days saved = (800 + 1231) ÷ 8 = 254
Permanent Fleet = 154 user days
Transient Fleet = 100 user days

In order to quantify the recreational benefit of the proposed improvement a dollar value for the user days saved by the improvements must be determined. This unit-day value was determined in accordance with procedures contained in Appendix 3 to Subpart K of the WRC manual. Recreational boating is considered to be "specialized recreation other than hunting or fishing." Point values were assigned for each criteria utilizing Table K-3-3 as published in 44 FR 72964, 14 December 1979. The point values are shown in Table 7.

TABLE 7
JOSIAS RIVER AT PERKINS COVE
RECREATIONAL POINTS COMPUTATION

Criteria	Point Value
Recreation Experience	16
Availability of Opportunity	10
Carrying Capacity	10
Accessibility	18
Environmental Quality	18
Total	72

The rating points are converted to dollar values by using the conversion table (revised Table K-3-1-FY 1982) found in the WRC FY 1982 Reference Handbook. As extrapolated from this table, 72 points represents a unit day value of $12.40. At this value the 254 user days of recreational boating time for the existing fleet saved by the proposed improvements equals about $3,200.

A summary of all recreational benefits is provided in Table 8.

TABLE 8
RECREATIONAL BENEFITS SUMMARY

Leisure Time Saved	
Transient Fleet	$ 1,200
Permanent Fleet	2,000
Reduced Damages	8,600
TOTAL RECREATIONAL BENEFITS =	$11,800
SAY	$12,000

Table 9 depicts the total quantified benefits resulting from the evaluated plan.

TABLE 9
TOTAL EVALUATED BENEFITS
SUMMARY

Recreational Benefits	$ 12,000	(4.7%)
Commercial Benefits	242,000	(95.3%)
TOTAL BENEFITS	$254,000	

Comparison of Benefits and Costs

A proposed plan's contribution to the national economic development is measured by comparing the project's annual benefits and costs as a ratio. If the benefits exceed the costs, the benefit-cost ratio (BCR) will be greater than one. If the BCR is greater than or equal to 1:0 the plan is considered to have a positive effect on national economic development. The BCR for the evaluated plan is presented in Table 10.

TABLE 10
BENEFIT-COST COMPARISON
COMPUTATION OF THE BENEFIT-COST RATIO

	Annual Benefits	Annual Costs	B/C Ratio	Net Benefits
Evaluated Plan of Improvement	$254,000	$41,000	6.2:1	$213,000

Apportionment of Cost

The first cost of construction of the evaluated plan is apportioned between Federal and non-Federal interests in proportion to commercial and recreational benefits. The first cost of construction of the portion of the project for which benefits are accrued by the commercial fleet will be borne entirely by the Federal Government. The first cost for that portion of the evaluated plan for which benefits are accrued by the recreational fleet are apportioned 50 percent Federal and 50 percent non-Federal. Based on total first costs for all improvements, the apportionment of costs is 97.6 percent Federal and 2.4 percent non-Federal.

Allocation of Cost

All of the Federal costs of this evaluated plan would be attributed to deepening of the entrance channel and lower half of the anchorage basin.

Federal Responsibilities

Of the first cost of project construction, 97.6 percent would be a Federal responsibility because of the mixed use commercial/recreational nature of the project. All costs of navigation aids and future maintenance, assuming continued justification, availability of funds, and environmental acceptability, would also be a Federal responsibility. The Federal share is presently estimated at $416,000.

Local Responsibilities

Local interests would be required to:

(1) Provide a cash contribution toward construction costs, determined in accordance with existing policies for regularly authorized projects, in view of recreational benefits, land enhancement benefits, or similar type special and local benefits excepted to accrue. The present basis for cost sharing in recreational small-boat projects provides that the Federal Government will participate in not more than 50 percent of the first cost of general navigation facilities serving recreational traffic. The evaluated plan of improvement would result in benefits to both commercial and recreational boating. Since recreational benefits account for 4.7% of the total benefits, the required local cash contribution will equal 2.4% of the first cost of construction. This amount is presently estimated at $10,000.

(2) Provide, maintain, and operate without cost to the United States an adequate public landing with provisions for the sale of motor fuel, lubricants, and potable water open and available to the use of all on equal terms.

(3) Provide without cost to the United States all necessary lands, easements, and rights-of-way required for construction and subsequent maintenance of the project including suitable dredged material disposal areas with necessary retaining dikes, bulkheads, and embankments therefore.

(4) Hold and save the United States free from damages that may result from construction and maintenance of the project.

(5) Accomplish without cost to the United States alterations and relocations as required in sewer, water supply, drainage, and other utility facilities.

(6) Provide and maintain berths, floats, piers, and similar marina and mooring facilities as needed for transient and local vessels as well as necessary access roads, parking areas, and other needed public use shore facilities open and available to all on equal terms. Only minimum, basic facilities and services are required as part of the project. The actual scope or extent of facilities and services provided over and above the required minimum is a matter of local decision. The manner of financing such facilities and services is a local responsibility.

(7) Assume full responsibility for all project costs in excess of the Federal cost limitation of $2,000,000.

(8) Establish regulations prohibiting the discharge of untreated sewage, garbage, and other pollutants in the waters of the harbor users thereof, which regulations shall be in accordance with applicable laws or regulations of Federal, State, and local authorities responsible for pollution prevention and control.

CONCLUSIONS

Conclusions

According to preliminary analyses, there is at least one economically feasible plan for navigation improvements in the study area. Local interests strongly support such navigation improvements as would allow for greater and more efficient utilization of the existing Federal project by both the existing commercial fishing fleet and seasonal recreational boating interests. Much more detailed analyses would be required before any final recommendations can be made, assuming an economically and environmentally sound solution to identified local problems and needs can be accomplished.

Recommendation

Further detailed study of navigation improvements for the Josias River at Perkins Cove, Ogunquit, Maine.